Name: ________________ Date: ________________

Polynomial Operations SOLUTION (version 118)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = x^5 - 9x^4 + 2x^3 - 7x^2 - 5$$

$$q(x) = -5x^5 + 8x^4 - 2x^3 + x + 6$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (1)x^5 + (-9)x^4 + (2)x^3 + (-7)x^2 + (0)x^1 + (-5)x^0 \\ q(x) &= (-5)x^5 + (8)x^4 + (-2)x^3 + (0)x^2 + (1)x^1 + (6)x^0 \\ q(x) - p(x) &= (-6)x^5 + (17)x^4 + (-4)x^3 + (7)x^2 + (1)x^1 + (11)x^0 \\ q(x) - p(x) &= -6x^5 + 17x^4 - 4x^3 + 7x^2 + x + 11 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 2x^2 + 5x + 8$$

$$b(x) = -4x + 3$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$2x^2$	$5x$	8
$-4x$	$-8x^3$	$-20x^2$	$-32x$
3	$6x^2$	$15x$	24

$$a(x) \cdot b(x) = -8x^3 - 20x^2 + 6x^2 - 32x + 15x + 24$$

Combine like terms.

$$a(x) \cdot b(x) = -8x^3 - 14x^2 - 17x + 24$$

3. Express $(x + 1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 118)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 7x^3 + 28x^2 + x - 6 \\ g(x) &= x + 4 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+4}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 7 & 28 & 1 & -6 \\ -4 & & -28 & 0 & -4 \\ \hline & 7 & 0 & 1 & -10 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 7x^2 + 1 + \frac{-10}{x+4}$$

In other words, $h(x) = 7x^2 + 1$ and the remainder is $R = -10$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 7x^3 + 28x^2 + x - 6$. Evaluate $f(-4)$.

You could do this the hard way.

$$\begin{aligned} f(-4) &= (7) \cdot (-4)^3 \; + \; (28) \cdot (-4)^2 \; + \; (1) \cdot (-4) \; + \; (-6) \\ &= (7) \cdot (-64) \; + \; (28) \cdot (16) \; + \; (1) \cdot (-4) \; + \; (-6) \\ &= (-448) \; + \; (448) \; + \; (-4) \; + \; (-6) \\ &= -10 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-4)$ equals the remainder when $f(x)$ is divided by $x + 4$. Thus, $f(-4) = -10$.